# VSX4 and VSX8 Series Controller

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**WARNING**

**Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion and/or fire causing property damage and personal injury or death.**

**Fisher® controller must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson Process Management Regulator Technologies, Inc. (Emerson™) instructions.**

**Only a qualified person must install or service the VSX4 and VSX8 Series controller. If a leak develops or if the controller continually vents gas, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.**

**Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operations which may result in equipment damage or personal injury.**

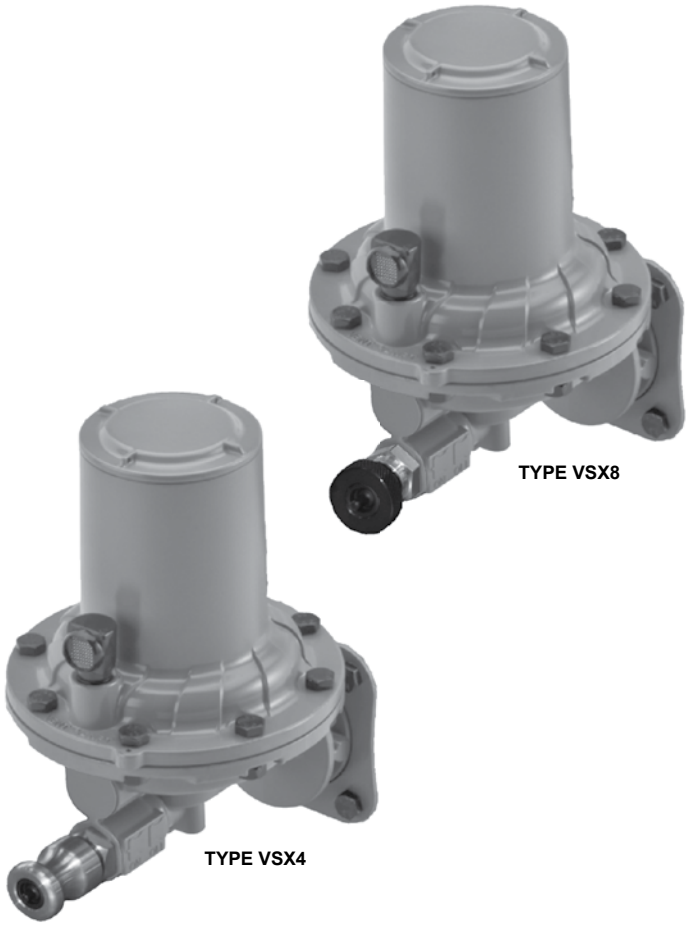



***Figure 1.*** *VSX4 and VSX8 Series Controller*

**The VSX4 and VSX8 Series controller do not activate in response to fire, seismic and lightning events.**

## Introduction

### Scope of the Manual

This Instruction Manual provides installation, adjustment, maintenance and parts ordering information for the VSX4 and VSX8 Series controller. Instructions for other equipment used with the controller, such as pressure regulators, can be found in separate instruction manuals.

D103127X012

## Specifications

The Specifications section lists the specifications for the VSX4 and VSX8 Series controller. The following information is stamped on the nameplate of VSX4 and VSX8 Series: Type and Class, Maximum Outlet Pressure and Spring Range. Additional operating information is located on the Regulator nameplate.

**Available Configurations**

**Types VSX4L and VSX8L:** Low-pressure controller which can be integrated into a regulator; with 10 to 1100 mbar / 0.15 to 16 psig downstream pressure and with either internal or external pressure registration for the regulator.

**Type VSX4H and VSX8H:** High-pressure controller which can be integrated into a regulator; with 1100 to 4000 mbar / 16 to 58 psig downstream pressure and with either internal or external pressure registration for the regulator.

**Controller Type**

**DS:** Differential Strength

**IS:** Integral Strength

**Functional Class**

**A:** Min, Min and Max Installation

**B:** Max Installation Only

**Connections**

**Controller Vent:** 1/4 NPT

**External Sensing Line:** 1/4 NPT

**Maximum Allowable Pressure (PS)[1]**

**Differential Strength:** 20.0 bar / 290 psig

**Integral Strength:** 6.0 bar / 87 psig

**Specific Maximum Allowable Pressure ($PS_d$)[1]**

6.0 bar / 87 psig

**Maximum Inlet Pressure ($P_{umax}$)[1]**

**Differential Strength (DS):** 16.0 bar / 232 psig

**Integral Strength (IS):** 6.0 bar / 87 psig

**Valve Plug Size**

**Medium Capacity Body (MC) Ø:**
24 mm / 0.94 in.

**High Capacity Body (HC) Ø:**
39 mm / 1.54 in.

**Operating Temperature (TS)[1]**

**According to PED Standards**
-20 to 66°C / -4 to 150°F

**Non-PED:** -30 to 66°C / -22 to 150°F

**Casing Material**

Aluminum

**Response Time ($t_a$)**

< 1 second

**Resetting Trip Mechanism**

Manually after Fault Rectification

**Position Indicator**

Extended stem visible in center of reset button

**Pressure Registration**

Internal or External

**European EN Reference Standard**

EN 14382

**Approximate Shipping Weights**

**Type VSX4L/VSX8L:** 1.4 kg / 3.1 lbs

**Type VSX4H:** 1.5 kg / 3.2 lbs

**Options**

- **Wire Seal** - The VSX4 and VSX8 Series can be ordered with an optional tamper-proof lock wire to preclude unauthorized access to the adjustment springs.
- **Limit switch** (inductive contact available only on Type VSX8) - An optional remote notification switch can be installed offering the capability to remotely notify the operator should Type VSX8 shuttoff occur.

**Pressure Drop**

$$\Delta P = \frac{P_u - \sqrt{P_u^2 - 4\left(\frac{Q}{1.05 \times C_g}\right)^2}}{2}$$

1. The pressure/temperature limits in this Instruction Manual or any applicable standard limitation should not be exceeded.

## Product Description

The VSX4 and VSX8 Series controller are designed to shut off the flow of gas to the downstream system in the event of outlet pressure rising above or falling below the predefined levels.

- The VSX4 and VSX8 Series can be integrated in a slam-shut Type VS100 installed upstream of the associated regulator.
- The VSX4 and VSX8 Series controller are equipped with an integral and automatic bypass.
- The VSX4 and VSX8 Series controller can be mounted on various types of Emerson™ regulator. It can also be mounted as a stand alone slam-shut valve mounted in a Type VS100 body.
- The VSX4 and VSX8 Series offer either internal or external pressure sensing line, depending on the regulator type and/or the specified conditions.

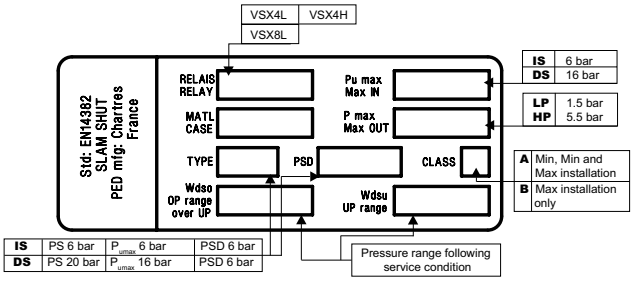



***Figure 2.*** *EN 14382-VSX4/VSX8 Series Label*

***Table 1.*** *VSX4 and VSX8 Series Overpressure Shutoff (OPSO) Spring Ranges*

| REGULATOR SETPOINT | | | | | | SLAM SHUT | | |
|---|---|---|---|---|---|---|---|---|
| Minimum | | Nominal | | Maximum | | Type | Spring Range | Part Number |
| mbar | psig | mbar | psig | mbar | psig | | Overpressure Shutoff (OPSO) Range[1][2] | OPSO Spring |
| 10 | 0.15 | 20 | 0.29 | 30 | 0.44 | VSX4L, VSX8L | 30 to 60 mbar / 12 to 25 in. w.c. | GF02168X012 |
| > 30 | 0.44 | 35 | 0.51 | 50 | 0.73 | | 40 to 110 mbar / 16 to 43 in. w.c. | GF02169X012 |
| > 50 | 0.73 | 60 | 0.87 | 80 | 1.16 | | 60 to 190 mbar / 25 to 75 in. w.c. | GF02170X012 |
| > 80 | 1.16 | 100 | 1.45 | 130 | 1.89 | | 95 to 280 mbar / 1.4 to 4.1 psig | GF02171X012 |
| > 130 | 1.89 | 160 | 2.32 | 250 | 3.63 | | 140 to 500 mbar / 2.0 to 7.3 psig | GF02172X012 |
| > 250 | 3.63 | 300 | 4.35 | 400 | 5.80 | | | |
| > 400 | 5.80 | 500 | 7.25 | 700 | 10.2 | | 400 to 1450 mbar / 5.8 to 21.0 psig | GF04353X012 |
| > 700 | 10.2 | 1000 | 14.5 | 1100 | 16.0 | | | |
| > 1100 | 16.0 | 1250 | 18.1 | 1500 | 21.8 | VSX4H | 0.90 bar to 3.0 bar / 13.1 to 43.5 psig | GF02173X012 |
| > 1500 | 21.8 | 2000 | 29.0 | 2500 | 36.3 | | 1.6 to 5.5 bar / 23.2 to 79.8 psig | GF04353X012 |
| > 2500 | 36.3 | 3000 | 43.5 | 4000 | 58.0 | | | |

1. OPSO spring range for OPSO installation only.
2. When selecting OPSO set points, the outlet pressure rating of the regulator should be considered.

***Table 2A.*** *VSX4 and VSX8 Series Combined Overpressure and Underpressure Shutoff (OPSO and UPSO) Spring Ranges for Types CSB404, CSB604 and CSB704*

| REGULATOR | | | | | | TYPE | SPRING RANGE | | | | | | | | SPRING PART NUMBER AND COLOR | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Minimum | | Maximum | | Typical Setpoint | | | Under Pressure Shutoff UPSO | | | | Over Pressure Shutoff OPSO | | | | | |
| | | | | | | | Spring Range | | Factory Set | | Spring Range | | Factory Set | | | |
| mbar | psig | mbar | psig | mbar | psig | | mbar | psig | mbar | psig | mbar | psig | mbar | psig | UPSO | OPSO |
| 17 | 0.25 | 24 | 0.35 | 20 | 0.29 | VSX4L, VSX8L | 5 to 30 | 0.07 to 0.44 | 10 | 0.15 | 30 to 60 | 0.4 to 0.9 | 43 | 0.62 | ERAA05835AO White | GF02167X012 Black |
| | | | | 21 | 0.3 | | | | 11 | 0.26 | | | 45 | 0.65 | | |
| 24 | 0.35 | 35 | 0.51 | 27 | 0.39 | | | | 14 | 0.2 | | | 51 | 0.74 | | |
| | | | | 30 | 0.44 | | | | 15 | 0.22 | | | 57 | 0.83 | | |
| | | | | 35 | 0.5 | | | | 18 | 0.26 | 50 to 130 | 0.7 to 1.9 | 67 | 1 | | GF02168X012 Brown |
| 35 | 0.51 | 60 | 0.87 | 50 | 0.7 | | 10 to 75 | 0.15 to 1.1 | 25 | 0.36 | | | 90 | 1.3 | T14169T0012 Blue | |
| | | | | 60 | 0.87 | | | | 30 | 0.44 | | | 108 | 1.57 | | |
| 54 | 0.78 | 100 | 1.5 | 75 | 1.1 | | | | 38 | 0.54 | 95 to 270 | 1.4 to 3.9 | 128 | 1.85 | | GF02169X012 Red |
| | | | | 100 | 1.5 | | | | 50 | 0.73 | | | 170 | 2.47 | | |
| 100 | 1.5 | 160 | 2.3 | 150 | 2.2 | | 25 to 159 | 0.36 to 2.3 | 75 | 1.1 | 150 to 380 | 2.2 to 5.5 | 248 | 3.6 | T14170T0012 Silver | GF02170X012 Orange |
| | | | | 160 | 2.3 | | | | 80 | 1.2 | | | 264 | 3.83 | | |
| 160 | 2.3 | 300 | 4.4 | 300 | 4.4 | | 100 to 500 | 1.5 to 7.3 | 150 | 2.2 | 260 to 600 | 3.8 to 8.7 | 450 | 6.53 | FA142869X12 Orange Stripe | GF02171X012 Pink |
| 276 | 4 | 517 | 7.5 | 500 | 7.3 | | | | 250 | 3.6 | 400 to 1100 | 5.8 to 16 | 700 | 10.2 | | GF02172X012 Green |
| 500 | 7.3 | 1000 | 14.5 | 1000 | 14.5 | | 100 to 750 | 1.5 to 10.9 | 500 | 7.3 | 800 to 1600 | 11.6 to 23.2 | 1320 | 19.2 | T14171T0012 Olive | GF02173X012 Silver |
| 1000 | 14.5 | 3000 | 43.5 | 1200 | 17.4 | VSX4H, VSX8H | 500 to 2000 | 7.3 to 29 | 600 | 8.7 | 1100 to 2000 | 16 to 29 | 1600 | 23.2 | FA142869X12 Orange Stripe | GF02171X012 Pink |
| | | | | 1500 | 21.6 | | | | 750 | 10.9 | 1700 to 3700 | 24.7 to 53.7 | 1900 | 27.6 | | GF02172X012 Green |
| | | | | 2000 | 29 | | | | 1000 | 14.5 | | | 2400 | 34.8 | | |
| | | | | 3000 | 43.5 | | 500 to 2800 | 7.3 to 40.6 | 1500 | 21.8 | 2800 to 5500 | 40.6 to 79.8 | 3400 | 49.3 | T14171T0012 Olive | GF02173X012 Silver |
| | | | | 4000 | 58 | | | | 2000 | 29 | | | 4400 | 63.8 | | |

***Table 2B.*** *Type VSX8L Combined Overpressure and Underpressure Shutoff (OPSO and UPSO) Spring Ranges for Type CS804*

| REGULATOR | | | | CONTROLLER | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Minimum | | Maximum | | Type | Spring Range | | | | Spring Part Number and Color |
| | | | | | Under Pressure Shut-off (UPSO) | | Over Pressure Shut-off (OPSO) | | |
| | | | | | Set Range UPSO | | Set Range Over UPSO | | |
| mbar | In. w.c. | mbar | In. w.c. | | mbar | In. w.c. | mbar | In. w.c. | UPSO | OPSO |
| 14<br>20<br>25 | 5.5<br>8<br>10 | 21<br>30<br>40 | 8.5<br>12<br>16 | VSX8L | 5 to 30 | 2 to 12 | 42 to 69 | 17 to 28 | ERAA05835A0<br>White | GF02168X012<br>Brown |
| 35<br>69 | 14<br>1 psig | 75<br>170 | 30<br>2.5 psig | | 25 to 160 | 0.36 to 2.3 psig | 90 to 214 | 1.3 to 3.1 psig | T14170T0012<br>Silver | GF02170X012<br>Orange |
| 100<br>170<br>345 | 1.5 psig<br>2.5 psig<br>5 psig | 240<br>380<br>690 | 3.5 psig<br>5.5 psig<br>10 psig | | 100 to 500 | 1.5 to 7.3 psig | 186 to 379 | 2.7 to 5.5 psig | FA142869X12<br>Orange Stripe | GF02171X012<br>Pink |

***Table 3.*** *Controller Accuracy in Accordance to EN 14382*

| ACCURACY GROUP (AG) | $P_d$ < 35 mbar / 0.507 psig | 35 mbar / 0.507 psig ≤ $P_d$ < 60 mbar / 0.87 psig | 60 mbar / 0.87 psig ≤ $P_d$ < 100 mbar / 1.5 psig | $P_d$ ≥ 100 mbar / 1.5 psig |
|---|---|---|---|---|
| $AG_{min}$ | 30 | 15 | 10 | 5 |
| $AG_{max}$ | 10 | 10 | | |
| Note: Stable inlet pressure $AG_{min}$ = AG 10 ($P_d$ < 60 mbar / 0.87 psig) and AG 5 ($P_d$ > 60 mbar / 0.87 psig), $AG_{max}$ = AG 5 | | | | |

***Table 4.*** *Controller Spring Part Numbers and Characteristics*

| SPRING VERSION | PRESSURE VERSION/TYPE | SPRING PART NUMBER | SPRING RANGE | | COLOR | SPRING WIRE DIAMETER | | SPRING FREE LENGTH | |
|---|---|---|---|---|---|---|---|---|---|
| | | | mbar | psig | | mm | In. | mm | In. |
| UPSO / Minimum Springs | VSX4L, VSX8L | ERAA05835A0 | 5 to 30 | 2 to 12 in. w.c. | White | 1.1 | 0.043 | 80.0 | 3.15 |
| | | T14169T0012 | 10 to 75 | 4 to 30 in. w.c. | Blue | 1.4 | 0.055 | 80.0 | 3.15 |
| | | T14170T0012 | 25 to 160 | 0.36 to 2.3 | Silver | 1.7 | 0.067 | 80.0 | 3.15 |
| | | FA142869X12 | 100 to 500 | 1.5 to 7.3 | Orange Stripe | 2.4 | 0.094 | 80.0 | 3.15 |
| | | T14171T0012 | 100 to 750 | 1.5 to 10.9 | Olive | 3.2 | 0.125 | 80.0 | 3.15 |
| | VSX4H, VSX8H | FA142869X12 | 0.50 to 2.0 bar | 7.3 to 29.0 | Orange Stripe | 2.4 | 0.094 | 80.0 | 3.15 |
| | | T14171T0012 | 0.50 to 2.8 bar | 7.3 to 40.7 | Olive | 3.2 | 0.125 | 80.0 | 3.15 |
| OPSO / Maximum Springs | VSX4L, VSX8L | GF02167X012 | 41 to 44(1) | 16 to 18 in. w.c.(1) | Black | 1.5 | 0.059 | 70.0 | 2.75 |
| | | GF02168X012 | 40 to 72(1) | 16 to 29 in. w.c.(1) | Brown | 1.8 | 0.071 | 70.0 | 2.75 |
| | | | 30 to 60(2) | 12 to 25 in. w.c.(2) | | | | | |
| | | GF02169X012 | 50 to 122(1) | 0.73 to 1.8(1) | Red | 2.2 | 0.087 | 70.0 | 2.75 |
| | | | 40 to 110(2) | 16 to 43 in. w.c.(2) | | | | | |
| | | GF02170X012 | 83 to 220(1) | 1.2 to 3.2(1) | Orange | 2.6 | 0.102 | 70.0 | 2.75 |
| | | | 60 to 190(2) | 25 to 75 in. w.c.(2) | | | | | |
| | | GF02171X012 | 180 to 384(1) | 2.6 to 5.6(1) | Pink | 3.0 | 0.118 | 70.0 | 2.75 |
| | | | 60 to 190(2) | 25 to 75 in. w.c.(2) | | | | | |
| | | GF02172X012 | 240 to 563(1) | 3.5 to 8.2(1) | Green | 3.4 | 0.134 | 70.0 | 2.75 |
| | | | 95 to 280(2) | 1.4 to 4.1(2) | | | | | |
| | | GF02173X012 | 460 to 932(1) | 6.7 to 13.5(1) | Silver | 4.0 | 0.157 | 70.0 | 2.75 |
| | | GF04353X012 | 400 to 1450(2) | 5.8 to 21.0(2) | Yellow | 4.8 | 0.189 | 70.0 | 2.75 |
| | VSX4H, VSX8H | GF02171X012 | 1.05 to 1.57 bar(1) | 15.2 to 22.8(1) | Pink | 3.0 | 0.118 | 70.0 | 2.75 |
| | | GF02172X012 | 1.25 to 2.30 bar(1) | 18.1 to 33.4(1) | Green | 3.4 | 0.134 | 70.0 | 2.75 |
| | | GF02173X012 | 2.10 to 3.75(1) | 30.5 to 54.4(1) | Silver | 4.0 | 0.157 | 70.0 | 2.75 |
| | | | 0.90 to 3(2) | 13.1 to 43.5(2) | | | | | |
| | | GF04353X012 | 1.5 to 5.5(2) | 21.8 to 79.8(2) | Yellow | 4.8 | 0.189 | 70.0 | 2.75 |

1. OPSO spring range for the combined OPSO and UPSO installation.
2. OPSO spring range for OPSO installation only.

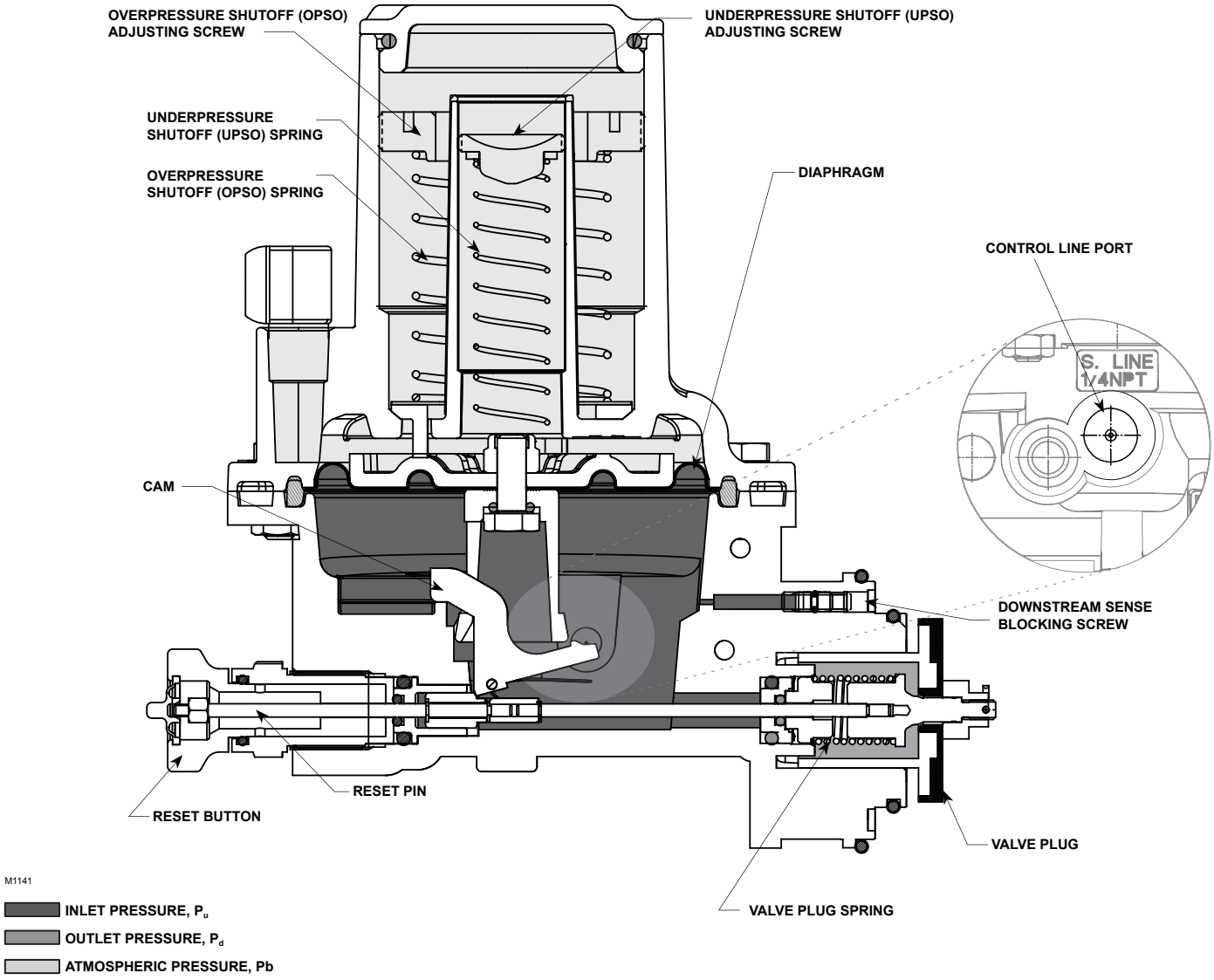



***Figure 3.*** *Type VSX8 Operational Schematic*

# Principle of Operation

## VSX4 and VSX8 Series Controller

The pressure measuring element of the controller consists of a diaphragm that senses downstream pressure. The downstream pressure is controlled by the regulator. The top side of the diaphragm encounters the force imposed by the overpressure shut-off spring and underpressure shut-off spring.

When the downstream pressure increases above the Overpressure Shutoff (OPSO) setting, the diaphragm moves up.

When the downstream pressure decreases below the Underpressure Shutoff (UPSO) setting, the diaphragm moves down.

Both of these actions result in the rotation of the cam and the release of the reset pin.

The valve plug spring moves the valve plug against the regulator port, stopping the flow of gas. The reset button is then used to reset (relatch) the controller *(refer to the Resetting Procedure section for detailed resetting instructions).*

Standard downstream pressure registration for the controller is external; however, internal sensing line is made available by removing the downstream sense blocking screw, installing a 1/4 NPT plug in the control line port and removing the downstream control line.

***Table 5.*** *Controller Standard Factory Settings*

| REGULATOR SETPOINT, mbar / psig | CONTROLLER STANDARD SETTINGS | | |
|---|---|---|---|
| | UPSO / Minimum | OPSO[1][2] / Maximum | OPSO[3] / Maximum |
| $P_d$ < 35 / 0.51 | $P_d$ x 0.5 | $P_d$ x 2.0 | $P_d$ x 2.0 + 10 mbar / 0.145 psig |
| 35 / 0.51 < = $P_d$ < 60 / 0.87 | $P_d$ x 0.5 | $P_d$ x 1.7 | $P_d$ x 1.7 + 10 mbar / 0.145 psig |
| 60 / 0.87 < = $P_d$ < 160 / 2.32 | $P_d$ x 0.6 | $P_d$ x 1.5 | $P_d$ x 1.5 + 10 mbar / 0.145 psig |
| 160 / 2.32 < = $P_d$ < 180 / 2.61 | $P_d$ x 0.7 | $P_d$ x 1.4 | $P_d$ x 1.4 + 10 mbar / 0.145 psig |
| 180 / 2.61 < = $P_d$ < 300 / 4.35 | $P_d$ x 0.7 | $P_d$ x 1.4 | ---- |
| 300 / 4.35 < = $P_d$ | $P_d$ x 0.7 | $P_d$ x 1.3 | |
| The VSX4 Series assembly part number (without valve plug and controller springs): LP: GE35589X012, HP: GE35590X012<br>The VSX8 Series assembly part number (without valve plug and controller springs): LP: ERCA02667A0, HP: ERCA02668A0 | | | |
| 1. Regulator without relief valve (or with relief valve set above controller setting).<br>2. When selecting OPSO set points, the outlet pressure rating of the regulator should be considered.<br>3. Regulator with relief valve (set below controller setting). | | | |

# Installation

**WARNING**

**Personal injury or system damage may result if this controller is installed, without appropriate overpressure protection, where service conditions could exceed the limits given by the nameplates of either the regulator or controller or exceed the limits indicated in the regulator or controller instruction manuals.**

**All vents should be kept open to permit free flow of gas to the atmosphere. Protect openings against entrance of rain, snow, insects or any other foreign material that may plug the vent or vent line. When installing outdoors, point the spring case vent of the regulator and of the controller downward to allow condensate to drain. This minimizes the possibility of freezing and accumulation of water or other foreign materials entering the vent and interfering with proper operation.**

**Controller installations should be adequately protected from physical damage.**

**The equipment should not receive any type of shock causing damage to the casing and therefore causing leaks.**

**No modification should be made to the structure of the equipment (drilling, grinding and soldering).**

**Under enclosed conditions or indoors, escaping gas may accumulate and be an explosion hazard. In these cases, the vent(s) should be piped away from the regulator/controller to the outdoors.**

**Failure to install a downstream control line could result in a hazardous condition. Install downstream control line(s) to the controller when construction uses external pressure registration. The regulator and controller will not control pressure or shut off if a downstream control line is not installed on those constructions where external pressure sensing line is required.**

**If the controller is exposed to an overpressure condition, it should be inspected for any damage that may have occurred. Controller operation within ratings does not preclude the possibility of damage from external sources or from debris in the pipeline.**

## General Installation Instructions

**Note**

**The VSX4 and VSX8 Series can be rotated 360° for easy installation and maintenance.**

- Install according to EN 12186 and EN 12279.

Before proceeding to installation:

- Ensure that the controller is compatible with the gas being regulated.
- Check for damage that might have occurred during shipment.
- Check for and remove any dirt or foreign material that may have accumulated in the regulator or controller body.
- Blow out any debris or dirt in the tubing and the pipeline.
- Ensure that the external or internal sense orifice is clean.
- Apply pipe compound to the external threads of the pipeline before installing the controller.
- Verify that:
  - Equipment limits of utilization (PS, TS) correspond to the desired operating conditions.
  - The inlet is protected by an appropriate device(s) to avoid exceeding the allowable limits (PS, TS).
  - The controller and its springs correspond to the desired operating conditions of associated regulator.

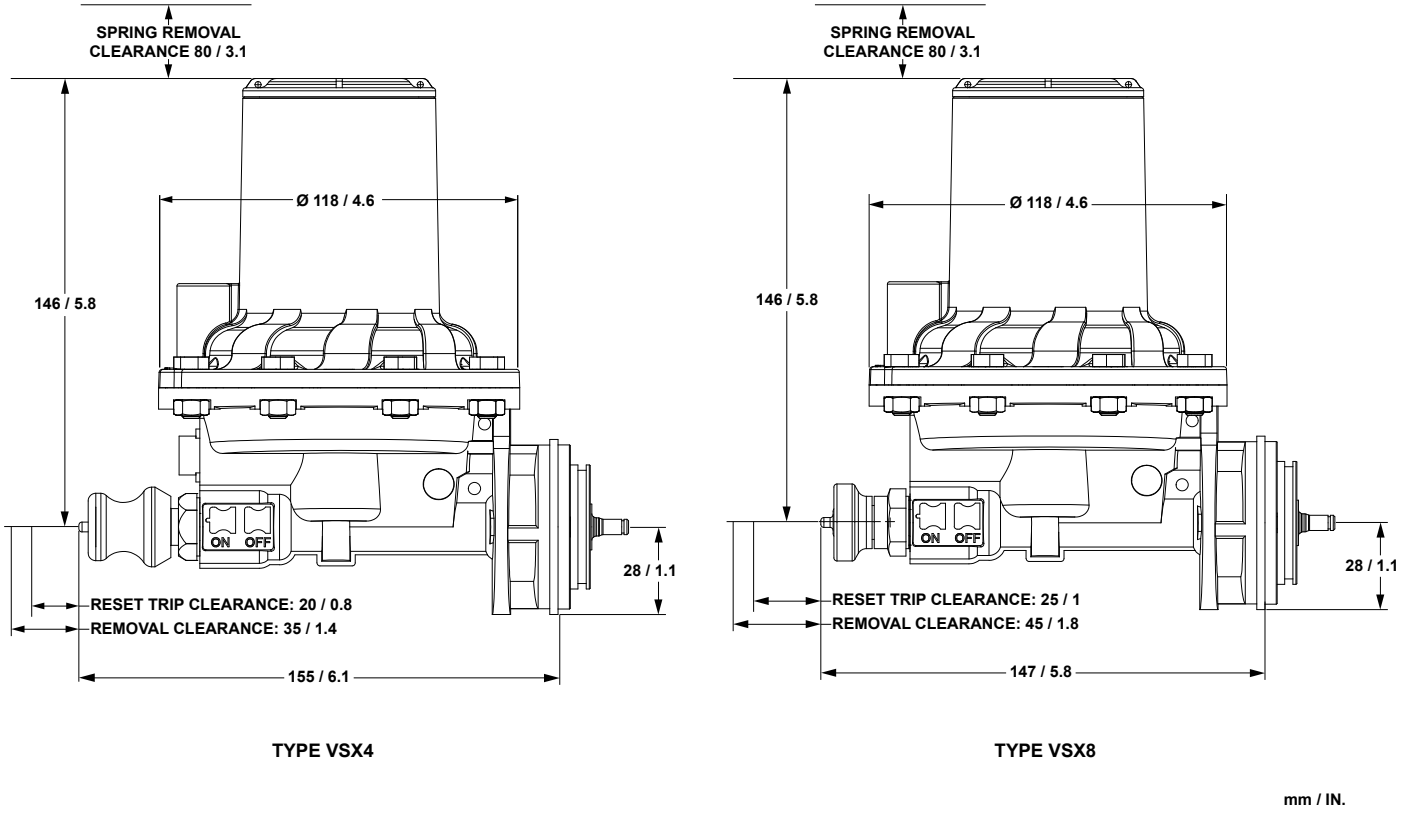



***Figure 4.*** *Controller External Dimensions*

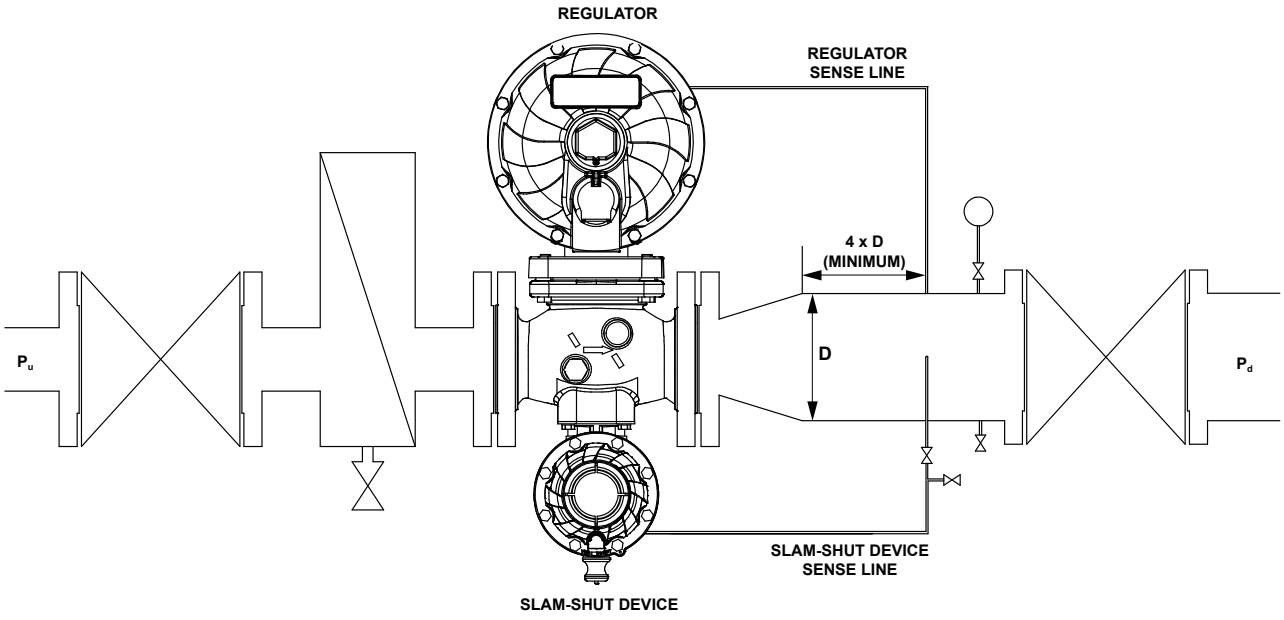



***Figure 5.*** *Typical Installation*

- When assembling piping and flanges, do not apply excessive force to the body, bolts, O-rings, flanges or fittings. All connections should be compatible with the geometry and working conditions of the pipeline.
- If needed, a support may be used under the piping and regulator/controller body to avoid excessive pressure force on the regulator/controller.
- Connect downstream control line tubing to the 1/4 NPT connection in the lower casing and to the downstream pipe respecting a minimum distance of four times its diameter (see Figure 5).
- Periodically check all vent openings to be sure that they are not plugged.

## Startup and Shutdown

**CAUTION**

**This Instruction Manual should be used in conjunction with the instruction manual of the associated equipment.**

## Commissioning

**WARNING**

**All interventions on the equipment should only be performed by competent and trained personnel.**

## Controller Spring Adjustment

**WARNING**

**Before proceeding with the adjustment of the controller springs, the operator must ensure upstream and downstream valves are closed and adjusting screws (keys 43 and 40, Figure 13) are unscrewed (refer to Table 6).**

### Overpressure and Underpressure Shutoff (OPSO / UPSO) Setpoint Adjustment (Figure 3)

- Using a flathead screwdriver, turn the OPSO adjusting screw (key 43) clockwise until it stops turning.
- Apply nominal outlet pressure of the associated regulator to the downstream system. Refer to Figure 5.
- Reset the controller per the resetting procedure *(refer to the Resetting Procedure section for detailed resetting instructions).*
- Slowly decrease the downstream pressure to the desired UPSO value ($P_{dsu}$).
- With a screwdriver, turn the UPSO adjusting screw clockwise (key 40) until the controller trips.
- Apply nominal outlet pressure of the associated regulator to the downstream system.
- Reset the controller by pulling the reset button (key 30) until the mechanism is latched.
- Slowly increase the downstream pressure to the desired OPSO shutoff value ($P_{dso}$).
- With a screwdriver, turn the OPSO adjusting screw counterclockwise (key 43) until the controller trips.

### Overpressure Shutoff (OPSO) Setpoint Adjustment Only (Figure 3)

- Using a flathead screwdriver, completely remove and discard the UPSO adjusting screw (key 40) by turning it counterclockwise.
- Remove and discard the UPSO spring (key 38) and the mini washer (key 103).
- Using a flathead screwdriver, turn the OPSO adjusting screw (key 43) clockwise until it stops turning.
- Apply nominal outlet pressure of the associated regulator to the downstream system.
- Reset the controller per the resetting procedure, *(Refer to the Resetting Procedure section for detailed resetting instructions).*
- Slowly increase the downstream pressure to the desired OPSO value ($P_{dso}$).
- Using a flathead screwdriver, turn the OPSO adjusting screw counterclockwise (key 43) until the controller trips.

### Underpressure Shutoff (UPSO) Setpoint Adjustment Only (Figure 3)

- Using a flathead screwdriver, turn the OPSO adjusting screw (key 43) clockwise until it stops turning.
- Apply nominal outlet pressure of the associated regulator to the downstream system, then reset the controller per the resetting procedure *(refer to the Resetting Procedure section for detailed resetting instructions).*
- Slowly decrease the downstream pressure to the desired UPSO value ($P_{dsu}$).
- With a screwdriver, turn the UPSO adjusting screw clockwise (key 40) until the controller trips.

## Manual Shut-off Procedure (Figure 6)

Using a screwdriver, press the manual shut-off button (key 23) to manually trip the controller.

## Manual Reset Procedure (Figure 7) for VSX4 and VSX8 Series

**CAUTION**

**Equipment installed downstream the controller can be damaged if the following procedure for resetting the controller is not followed. This equipment includes the integral controller/regulator configurations.**

*Step 1:*

- To properly reset the controller after it has been tripped to the closed position, a flat-head screwdriver must be inserted into the position shown in Figure 8 on the backside of the reset button (key 30, Figure 8).

*Step 2:*

- The screwdriver should be slowly rotated to gradually pull the reset button (key 30) away from the controller. This slow movement allows for a slow bleed of the pressure across the controller's disk and seat area. The operator should be able to hear the pressure bleeding through the system.

*Step 3:*

- When the pressure has equalized and the air bleeding sound has dissipated, the reset button (key 30) should be pulled completely away from the controller by hand until the internal shut-off mechanism has been re-latched.

*Step 4:*

- Once the operator feels the click of the re-latch occurring, the reset button (key 30) should be pushed completely back into its original position.

## Travel Indicator (Figures 11 and 12)

The travel indicator (key 27) provides a visual indication as to whether the controller is opened (latched/reset) or closed (tripped).

## Controller in Open (Reset) Position (Figure 11)

When the controller is in the open position, the travel indicator (key 27) is visible and firm when pressed with a finger.

## Controller in Closed (Tripped) Position (Figure 12)

When the controller is in the closed position, the travel indicator (key 27) is not visible and easily moved when pressed inward with a finger.

# Maintenance

**WARNING**

**Only a competent and qualified person may perform maintenance procedures. If necessary, contact your local Sales Office for assistance.**

**Failure to test the controller for proper shutoff can result in a hazardous condition. Test the controller for operation per applicable federal, state and local codes, rules and regulations and Emerson™ instructions.**

**Due to normal wear or damage that may occur from external sources, the controller should be inspected and maintained periodically. The frequency of inspection and replacement depends on the severity of service conditions and on applicable codes and regulations. In accordance with applicable National or Industry codes, standards and regulations/ recommendations, all hazards covered by specific tests after final assembly before applying the CE marking, shall also be covered after every subsequent reassembly at installation site, in order to ensure that the equipment will be safe throughout its intended life.**

**Periodic inspection must be performed on the VSX4 and VSX8 Series. The controller should be tested for both under and overpressure shutoff activation and pressure tight shutoff annually with test intervals not to exceed 15 months but at least once each calendar year. If the controller does not close at the desired pressures or leaks gas after closure, repair and/or replace the controller. For the verification of internal parts and replacement of worn parts, the controller should be disassembled every 3 years minimum.**

## Manual Shut-Off Button Procedure For VSX4 And VSX8 Series

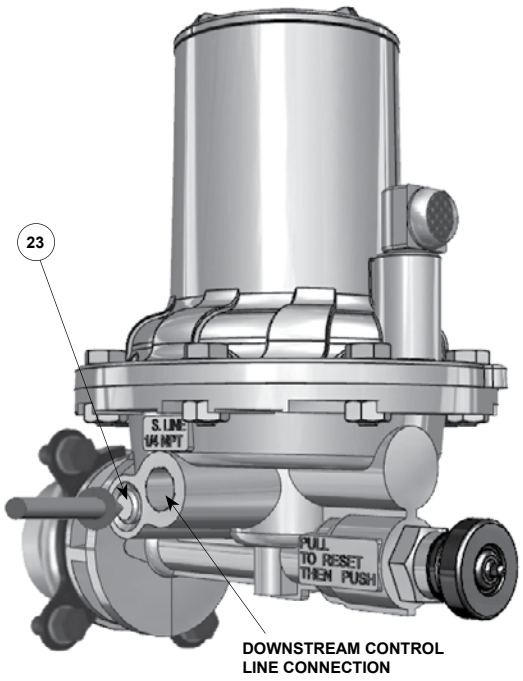



***Figure 6.*** *Controller Manual Shut-off Button (key 23)*

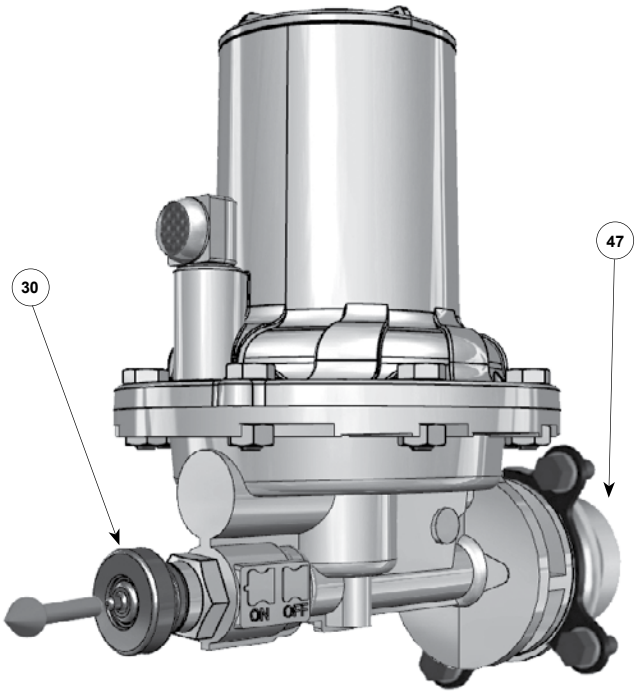



***Figure 7.*** *Controller Manual Bypass*

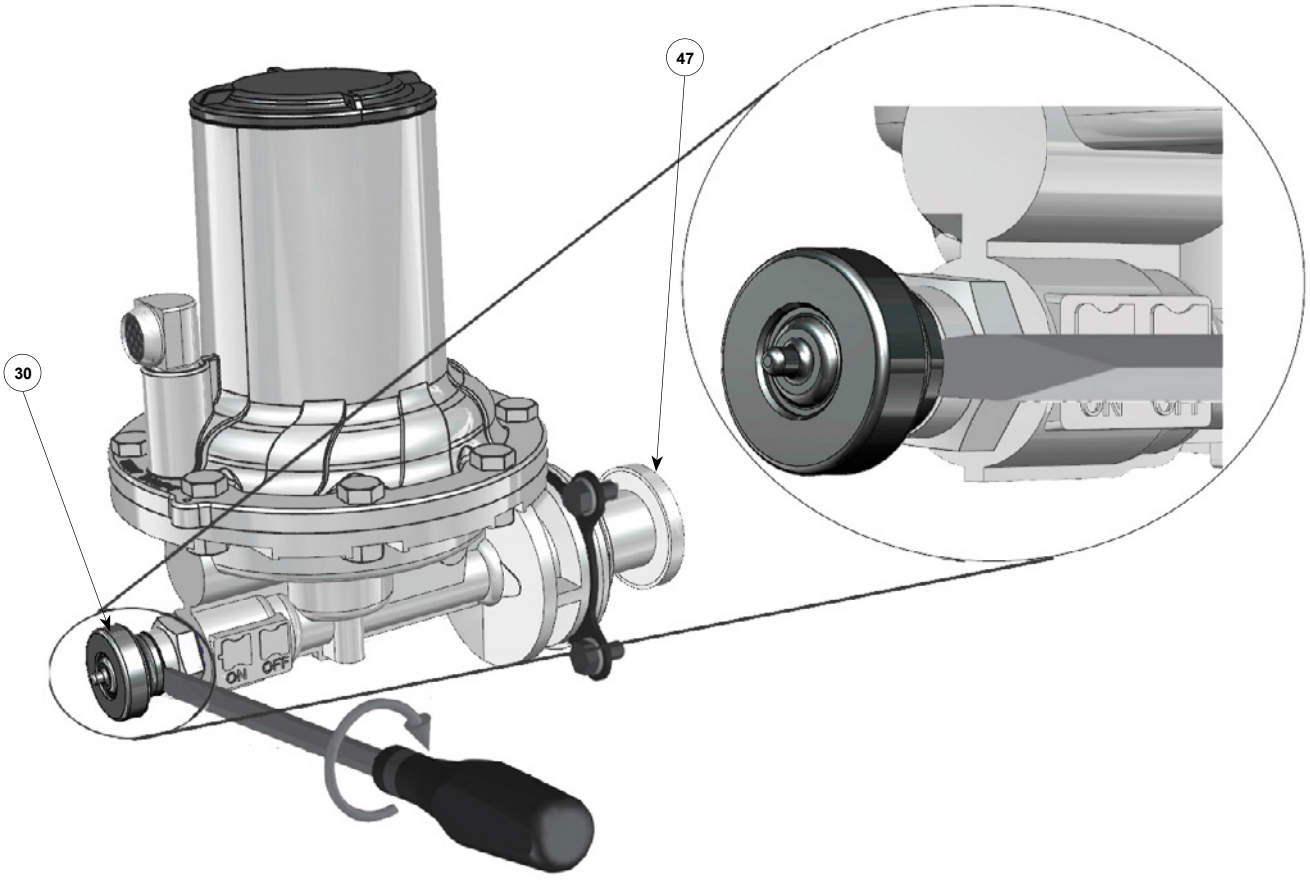



***Figure 8.*** *Controller Bypass with Screwdriver*

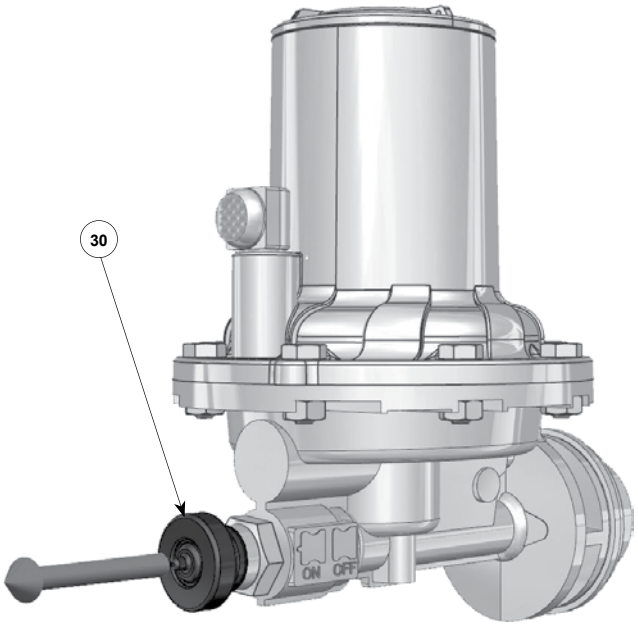



***Figure 9.*** *Relatching the Controller Mechanism*

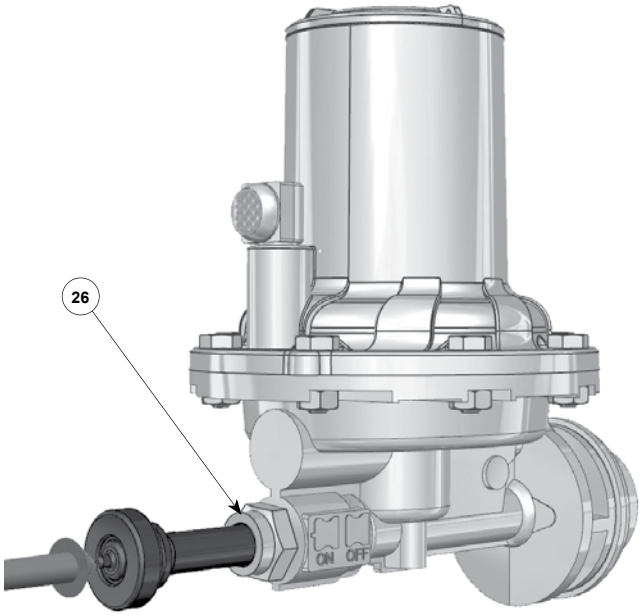



***Figure 10.*** *Repositioning the Reset Button*

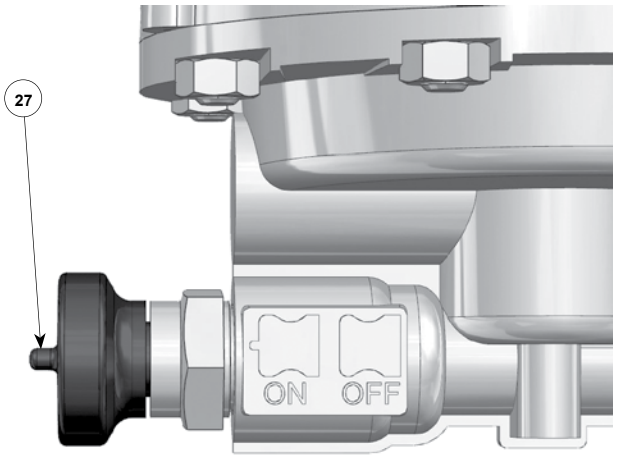



***Figure 11.*** *Controller in Open (Reset) Position*

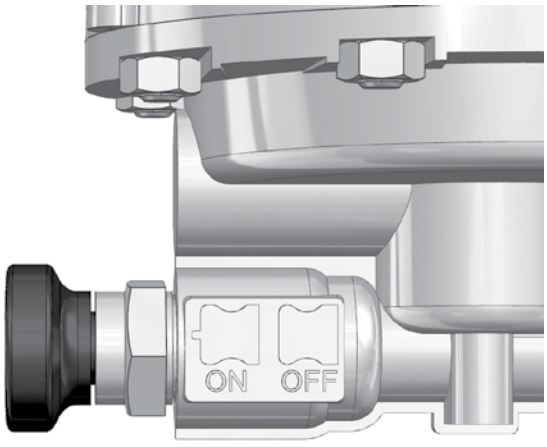



***Figure 12.*** *Controller in Closed (Tripped) Position*

## Systematic Maintenance is Recommended as Specified Below:

***Table 6.*** *Flow Chart for Checking Shut-off Mechanism*

| - CLOSE THE UPSTREAM VALVE<br>- CLOSE THE DOWNSTREAM VALVE | |
|---|---|
| **High-Pressure Shutoff** | **Low-Pressure Shutoff** |
| Supply pressure through outlet purge valve. | Open the purge valve. |
| Check the value of the shut-off pressure and for any downstream leakage. | Check the value of the shut-off pressure and for any downstream leakage. |
| Adjust the setpoint, if necessary. | Adjust the setpoint, if necessary. |

## Disassembly and Reassembly

**Note**

**User should only disassemble the controller to replace the Valve Plug (Disk), change registration from Internal to External and Spring and Diaphragm Replacement as described below.**

**All other internal disassembly requires special tooling and should be done only at the factory; for example the cam and reset pin assembly (key 4, Figure 13).**

## Valve Plug (Disk) Replacement

**WARNING**

**To avoid personal injury or equipment damage, do not attempt any maintenance or disassembly without first isolating the regulator/controller from system pressure and relieving all internal pressure.**

- Refer to Figure 13 when following this procedure. Remove the body flange screws (key 34) and the two half flanges (key 36). Remove the controller from the body. If disk replacement is required, remove the fastening ring (key 44). A specific tool is required for this, see Table 7.
- Remove and replace the valve plug (disk) (key 47, D24 mm medium capacity or D39 mm high capacity).
- Replace the fastening ring (key 44).
- Reassemble in reverse order, taking care to follow the steps outlined in the General Controller Reassembly Procedures section.

## Changing from Internal to External Registration

**WARNING**

**To avoid personal injury or equipment damage, do not attempt any maintenance or disassembly without first isolating the regulator/controller from system pressure and relieving all internal pressure.**

- Refer to Figure 13 when following this procedure. Remove the body flange screws (key 34) and the two half flanges (key 36). Remove the controller from the body.
- Install the sense blocking screw (key 51) and O-ring (key 50).
- Remove the 1/4 NPT plug from the 1/4 NPT Control line port (Figure 3).
- Reassemble in reverse order, ensure to follow the steps outlined in the General Controller Reassembly Procedures section.
- Connect a downstream control line with an outer diameter of 6.4 mm / 0.25 in. or larger to the 1/4 NPT Control line port shown in Figure 3 and to the downstream system as indicated in Figure 5.

## Spring and Diaphragm Replacement

- Refer to Figure 13 when following this procedure. Unscrew and remove the closing cap (key 3). Using a flathead screwdriver, unscrew and remove the OPSO adjusting screw (key 43), OPSO spring (key 41), maximum washer (key 42).
- Unscrew and remove the UPSO adjusting screw (key 40), mini washer (key 103) and UPSO spring (key 38).

***Table 7.*** *Recommended Tools*

| TOOL | USAGE |
|---|---|
| Flathead screwdriver | • Adjustment of Overpressure and Underpressure Shutoff (OPSO / UPSO) setting<br>• Resetting procedure |
| 10 mm / 0.394 in. Wrench | • Removal and installation of the actuator screws (key 16, Figure 13)<br>• Removal and installation of body flange screws (key 34)<br>• Removal and installation of the lock nut (key 31, Figure 13) |
| 14 mm / 0.551 in. Wrench | • Removal and installation of the external sense line 1/4 NPT connection (Figure 3) |
| Internal retaining ring pliers | • Removal and installation of the fastening ring (key 44) |

***Table 8.*** *VSX4 and VSX8 Series Troubleshooting*

| INDICATION | CAUSE | ACTION |
|---|---|---|
| If the valve will not close | Operating fault | Check the following:<br>• The shut-off pressure settings for high and low pressure values are correct.<br>• The O-rings are tight shut.<br>• The sensing line is plugged.<br>Remove the controller and check the following:<br>• The reset latch is not stuck.<br>• The state of the diaphragm assembly for wear and tear.<br>Or contact your local Sales Office. |
| If the downstream pressure in the controller decreases | External leak | Locate and seal the leak.<br>Or contact your local Sales Office. |
| If the outlet pressure in the controller is constant | - - - - | • Bleed off the outlet side of the regulator.<br>• Observe the evolution of the outlet pressure (check tightness). |
| If the downstream pressure in the controller increases | Internal leak | Check the following:<br>• The valve plug (disk)<br>• The internal interface O-ring (key 46, Figure 14)<br>• The reset stem O-ring (key 29, Figure 14)<br>Or contact your local Sales Office. |

- Using a 10 mm / 0.394 in. wrench, unscrew and remove the eight spring case screws (key 16) and associated nuts (key 12) and then remove the spring case (key 2). For Type VSX4H, remove the diaphragm support (key 32).
- To remove the diaphragm assembly, gently grasp the edge of the diaphragm (key 6) while at the same time pulling the reset button (key 30) slightly, which will allow for sliding the back plate (key 5) off of the cam (key 19).

  Grasp the back plate (key 5) and unscrew the nut (key 31) using a 10 mm / 0.394 in. wrench. Remove the diaphragm plate (key 7) and inspect the diaphragm and replace if necessary. The lock nut (key 31) should always be replaced.

  Reassemble in reverse order, ensure to follow steps outlined in the following section “General Controller Reassembly Procedures.” Note that when tightening the lock nut (key 31) onto screw (key 16), a hexagonal recess exists at the bottom of the back plate (key 5) that precludes the screw (key 16) from turning to allow the lock nut (key 31) to be threaded.

## General Controller Reassembly Procedures

- It is recommended that O-rings (keys 14 and 24) be replaced before reinstalling the controller valve onto the regulator body.
- Before reassembly, inspect removed O-rings for damage or wear and replace if necessary.
- Before reassembly, apply silicone grease lubricant to the appropriate O-rings.
- Using graphite molybdenum, grease appropriate screws, setting nuts and springs (keys 38, 40, 41, 43 and 103).
- Recommended torque for screws (key 16) is 6.0 N•m / 4.4 ft-lbs.
- Recommended torque for lock nut (key 31) is 3 N•m / 27 in-lbs.

## Parts Ordering

Controller that have been disassembled for repair must be tested for proper operation before being returned to service.

The type number, pressure ranges, functional class and date of manufacture are stamped on the nameplate. Always provide this information when corresponding with your local Sales Office regarding replacement parts or technical assistance.

When ordering replacement parts, refer to the key number of each needed part as found in the parts list.

Separate kits containing all recommended spare parts are available. See tables on pages 15 and 16.

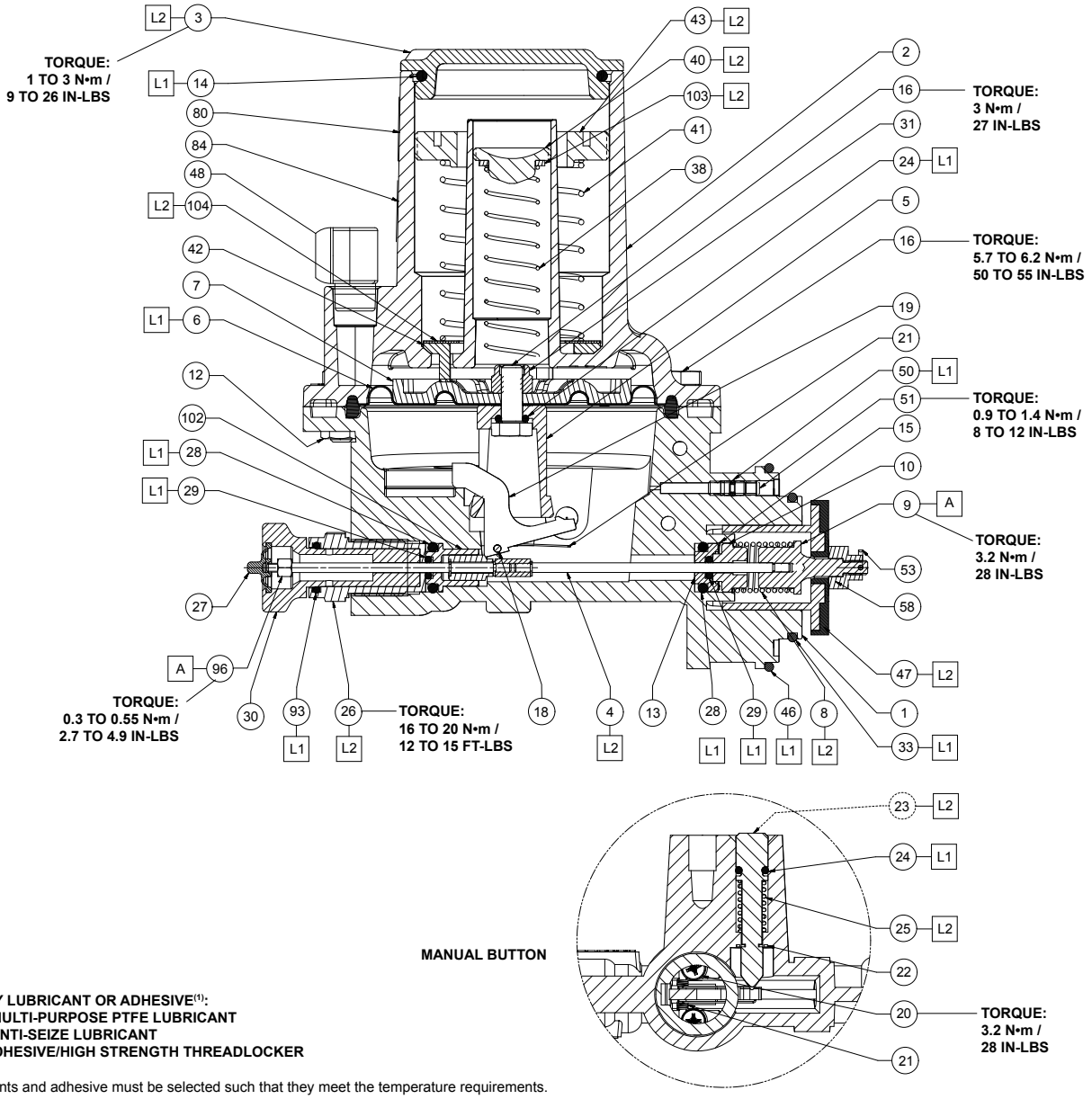
## Parts List

### VSX4 and VSX8 Series Controller

| KEY | IDENTIFICATION | PART NUMBER | | |
|---|---|---|---|---|
| | | Type VSX4L | Type VSX4H | Type VSX8L |
| 1 | Lower case | GF01865X012 | | ERCA00875A0 |
| 2 | Upper case | GF01866X012 | | |
| 3 | Closing cap | GF01922X012 | | |
| 4 | Reset pin | GF01936X012 | | ERAA06343A0 |
| 5 | Back plate | GF01926X012 | | |
| 6* | Diaphragm | GF01929X012 | | |
| 7* | Diaphragm plate | GF01927X012 | GF01944X012 | GF01927X012 |
| 8 | Valve plug spring | GF02174X012 | | ERAA06243A0 |
| 9 | Plug support | GF01939X012 | | ERAA05874A0 |
| 10 | Spring locator | GF01938X012 | | ERCA01265A0 |
| 11 | Fastening clip of reset pin (4 required) | FA406150X12 | | |
| 12 | Nut H M6 (8 required) | GE38209X012 | | |
| 13 | Ring (2 required) | GF01932X012 | | |
| 14* | Closing Cap O-ring (51.00 x 3.00) | GF03448X012 | | |
| 15 | Self-locking ring | FA406200X12 | | |
| 16* | Screw H M6 x 16 (8 for the spring case and 1 for the diaphragm assembly) | GE38207X012 | | |
| 17 | Connection ring (not shown) | GF01937X012 | | ---------- |
| 18 | Axis | GF01935X012 | | |
| 19 | Cam | ERCA00252A0 | | |
| 20 | Screw HM4 x 8 (2 required) | GF03474X012 | | |
| 21 | Flexing spring | GF04808X012 | | |
| 22 | Fastening clip | FA406153X12 | | |
| 23 | Manual button | GF01933X012 | | |
| 24 | O-ring (2 required) | GF03445X012 | | |
| 25 | Relatching spring | GF02175X012 | | |
| 26 | Gland sleeve | GF01931X012 | | ERAA05855A0 |
| 27 | Travel indicator diaphragm | GF01928X012 | | |
| 28 | O-ring R8 (8.90 x 2.70) (3 required for VSX4 Series, 2 required for VSX8 Series) | GF03446X012 | | |
| 29 | O-ring R1 (2.60 x 1.90) (2 required) | GF03447X012 | | |
| 30 | Reset button | GF01930X012 | | ERCA01254A0, ERCA01044A0[2] |
| 31* | Lock nut | FA404550X12 | | |
| 32 | Diaphragm support[1] (not shown) | ---------- | GF01934X012 | ---------- |
| 33* | Inlet O-ring 8073 (36.0 x 2.2) | GF03442X012 | | |
| 34 | Screw H M6x12 (not shown) (4 required) | GE38176X012 | | |
| 36 | Half flange (not shown) (2 required) | GF01942X012 | | |
| 38 | UPSO Spring | See Table 2 | | |
| 40 | UPSO Adjusting screw | ERAA05947A0 | | |
| 41 | OPSO Spring | See Tables 1 and 2 | | |
| 42 | Maximum washer | GF01925X012 | | |
| 43 | OPSO Adjusting screw | GF01923X012 | | |
| 44 | Fastening ring (not shown) | GF04079X012 | | ---------- |
| 46* | Outlet O-ring I 5370 (54.0 x 2.0) | GF03443X012 | | |
| 47* | VSX4 Series Valve plug D24/Disk (Medium capacity) | GF01940X012 | | ---------- |
| 47* | VSX8 Series Valve plug D39/Disk (High capacity) | ---------- | | ERAA05852A0 |
| 48 | Vent | 27A5516X012 | | |
| 49 | Plug, 1/4 NPT (not shown) (for Internal only) | 1C333528992 | | |
| 50* | Sense blocking O-ring (2.00 x 1.25) (for External only) | GF03449X012 | | |
| 51 | Sense Blocking Screw (for External only) | GF02261X012 | | |
| 52 | Limit switch | ---------- | | M4006669X12[2] |
| 53 | Travel stop | ---------- | | ERAA05924A0 |
| 54 | Positioner | | | ERCA01078A0[2] |
| 58 | Safety nut M4 | ---------- | | ERAA05875A0 |
| 80 | Base label | ---------- | | |
| 81 | O-ring (1.15 x 1.00) (not shown) (4 required) | GF03444X012 | | ---------- |
| 83 | Lockwire | T14088T0012 | | |
| 84 | Slamshut label | ---------- | | |
| 93 | O-ring R8 (10.82 x 1.78) | ---------- | | ERCA02550A0 |
| 96 | Nut M (2.5 x 0.45) | ---------- | | ERCA01387A0 |
| 102 | Ring Guide | ---------- | | ERAA05861A0 |
| 103 | Mini Washer (for UPSO spring) | ERAA05957A0 | | |
| 104 | Maxi Seat | ERAA05956A0 | | |

1. When adjusting the controller, refer to the Controller Spring Range tables, Tables 1 and 2, to ensure the desired set value is achievable for the controller construction, either low pressure (Type VSX4L or VSX8L) or high pressure (Type VSX4H).
2. Applicable for Type VSX8 with remote trip sensor.

*Recommended Spare Part

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☐ **APPLY LUBRICANT OR ADHESIVE(1):**
**L1 = MULTI-PURPOSE PTFE LUBRICANT**
**L2 = ANTI-SEIZE LUBRICANT**
**A = ADHESIVE/HIGH STRENGTH THREADLOCKER**

1. Lubricants and adhesive must be selected such that they meet the temperature requirements.

***Figure 13.*** *Controller Assembly*

| VSX4 AND VSX8 SERIES KIT | | | | | |
|---|---|---|---|---|---|
| **Key** | **Qty** | **Code** | **Description** | **Part Number** | |
| | | | | **Type VSX4L/VSX8L** | **Type VSX4H** |
| **Modification Kit to Change from Internal to External Sense** | | | | | |
| 50 | 1 | 197898 | Sense blocking O-ring (2.00 x 1.25) (for external only) | GF03449X012 | |
| 51 | 1 | | Sense blocking screw (for external only) | GF02261X012 | |
| **Diaphragm Replacement Kit** | | | | | |
| 6 | 1 | 197899 | Diaphragm | GF01929X012 | |
| 31 | 1 | | Lock nut | FA404550X12 | |
| **Modification Kit to Change from Low Pressure to High Pressure Construction** | | | | | |
| 7 | 1 | 197900 | Diaphragm plate | - - - - - - - - - - - | GF01944X012 |
| 32 | 1 | | Diaphragm support | - - - - - - - - - - - | GF01934X012 |
| 14 | 1 | | Closing cap O-ring | GF03448X012 | |
| 31 | 1 | | Lock nut | FA404550X12 | |
| *+ spring* | | | | *according to setpoint -- not included in the kit* | |
| **Modification Kit to Change from High Pressure to Low Pressure Construction** | | | | | |
| 7 | 1 | 197901 | Diaphragm plate | GF01927X012 | - - - - - - - - - - - |
| 14 | 1 | | Closing cap O-ring | GF03448X012 | |
| 31 | 1 | | Lock nut | FA404550X12 | |
| *+ spring* | | | | *according to setpoint -- not included in the kit* | |

| VSX4 AND VSX8 SERIES KIT (continued) | | | | |
|---|---|---|---|---|
| **Key** | **Qty** | **Code** | **Description** | **Part Number** |
| **VSX4 Series Repair Kit with Medium Capacity Disk and Diaphragm** | | | | |
| 6 | 1 | RVSX4MCX012 | Diaphragm | GF01929X012 |
| 14 | 1 | | Closing cap O-ring | GF03448X012 |
| 24 | 1 | | Diaphragm Assembly O-ring | GF03445X012 |
| 31 | 1 | | Lock nut | FA404550X12 |
| 33 | 1 | | Inlet O-ring | GF03442X012 |
| 46 | 1 | | Outlet O-ring | GF03443X012 |
| 47 | 1 | | Medium Capacity Disk | GF01940X012 |
| **VSX8 Series Repair Kit with Diaphragm and High Capacity Disk** | | | | |
| 6 | 1 | RVSX8X00012 | Diaphragm | GF01929X012 |
| 14 | 1 | | Closing cap O-ring | GF03448X012 |
| 24 | 1 | | Diaphragm Assembly O-ring | GF03445X012 |
| 31 | 1 | | Lock nut | FA404550X12 |
| 33 | 1 | | Inlet O-ring | GF03442X012 |
| 46 | 1 | | Outlet O-ring | GF03443X012 |
| 47 | 1 | | High Capacity Disk | ERAA05852A0 |

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